EXHIBIT 29

What is an Electronic Controller?

Definition

A controller is a comparative device that receives an input signal from a measured process variable, compares this value with that of a predetermined control point value (set point), and determines the appropriate amount of output signal required by the final control element to provide corrective action within a control loop.

An Electronic Controller uses electrical signals and digital algorithms to perform its receptive, comparative and corrective functions.

Principles of Operation

An electronic sensor (thermocouple, RTD or transmitter) installed at the measurement location continuously sends an input signal to the controller. At set intervals the controller compares this signal to a predefined set point. If the input signal deviates from the set point, the controller sends a corrective output signal to the control element. This electric signal must be converted to a pneumatic signal when used with an air operated valve, such as a Trerice Series 910 or 940 Control Valve. The conversion can be made using a Trerice TA901 I/P Transducer, which converts a 4 to 20 mA electric signal to a 3 to 15 psi air signal.

Features

An electronic controller is best suited for applications where large load changes are encountered and/or fast response changes are required. Trerice Electronic Controllers have full auto tuning and PID capabilities, and offer a host of available options, including user selectable inputs and ranges, outputs, setback functions, and alarms. An economical "on/off" only style is also available for simple control applications.

PID Control
PID control is a feature of most Trerice Electronic Controllers. PID combines the proportional, integral and derivative functions into a single unit.

- **Proportional (P)** — Proportional control reacts to the size of the deviation from set point when sending a corrective signal. The size of the corrective signal can be adjusted in relation to the size of the error by changing the width of the proportional band. A narrow proportional band will cause a large corrective action in relation to a given amount of error, while a wider proportional band will cause a smaller corrective action in relation to the same amount of error.

- **Integral (I)** — Integral control reacts to the length of time that the deviation from set point exists when sending a corrective signal. The longer the error exists, the greater the corrective signal.

- **Derivative (D)** — Derivative control reacts to the speed in which the deviation is changing. The corrective signal will be proportional to the rate of change within the process.

Controllers

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continued

Auto-Tuning

Auto-tuning will automatically select the optimum values for **P**, **I** and **D**, thus eliminating the need for the user to calculate and program these values at system startup. This feature can be overridden when so desired. On some models, the control element can be manually operated.

Selecting an Electronic Controller

All Trerice Electronic Controllers are designed to control the temperature or pressure of general industrial equipment and should be carefully selected to meet the demands of the particular application. The information contained within this catalog is offered only as a guide to assist in making the proper selection. Selection of the proper controller is the sole responsibility of the user. Improper application may cause process failure, resulting in possible personal injury or property damage.

Case Size

Case Size selection is determined by both available and designed space, and controller features. Trerice Electronic Controllers are available in the following panel sizes: 96 x 96 mm (¼ DIN), 72 x 72 mm, 48 x 96 mm (⅛ DIN), and 48 x 48 mm (¹/₁₆ DIN). The depth of the unit varies with the model selected.

Input

The Input is the measurement signal received by the controller from the sensor. A variety of input types are available, including thermocouple, RTD, voltage and current.

Control Output

The Control Output is the corrective signal transmitted from the controller to the control element. Various control output types are available, including contact, voltage, current and solid state relay driver.

Analog Output

The Analog Output is an optional secondary signal that transmits the measurement signal from the controller to a remote data acquisition device, such as a recorder, personal computer or display unit.

Alarms

Most models can be ordered with alarms, event outputs, or heater break alarms, which signal an external device to perform a specific task at a predetermined set point.

Setback Function

This feature, optionally available on some models, is designed to provide energy savings in applications where the process is idled at regular intervals through the connection of an external timer or switch.

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